

Subject: AGU abstract for 1676 clearance

Possible increase in nitric oxide production by lightning discharges due to catalytic effects of ice particles

We address the question of whether ice crystals with habits typically encountered by lightning discharges may serve as catalysts for the production of NO_x by lightning. If so, and if the effect is sufficiently large, it would need to be taken into account in estimates of global NO_x production by lightning. In this study, we make a series of plausible assumptions about the temperatures and concentrations of reactant species in the environment of discharges and we postulate a mechanism by which ice crystals could adsorb nitrogen atoms. We then compare production rates between uncatalyzed and catalyzed reactions at 2000 K, 3000 K, and 4000 K, temperatures observed in lightning channels during the cool-down period after a return stroke. Catalyzed NO production rates are greater at 2000 K, whereas uncatalyzed production occurs most rapidly at 4000 K. The channel temperature stays around 2000 K for a longer period of time than at 4000 K. The longer residence time at 2000 K is sufficient to allow fresh reactants to participate in the mix in. Therefore, our results suggest that nearly three times as much NO per flash is produced by ice-catalyzed reactions as compared with uncatalyzed reactions.

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This will be presented at the 2011 Fall Meeting of the American Geophysical Union in San Francisco, CA somewhere between December 5 and 9 (<http://sites.agu.org/fallmeeting/>).

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